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Claims

1. An automated planter comprising:
locating means arranged to locate a propagation tray;
5 plant extraction means adapted to pull a plant out of a propagation tray located
by the locating means; and
delivery means arranged to receive a plant extracted by the plant extraction
means and deliver the received plant to the ground.
- 10 2. A planter in accordance with claim 1, wherein the plant extraction means comprises at least one insertion member for insertion into a root portion of a plant in a located tray, through the upper surface of the root portion, to grip the root portion.
3. A planter in accordance with claim 1 or claim 2, wherein the plant extraction
15 means comprises at least two fingers for insertion into the root portion of a plant in a located tray.
4. A planter in accordance with claim 3, wherein the plant extraction means comprises actuator means comparable to cause the fingers to converge.
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5. A planter in accordance with claim 3 or claim 4, wherein the fingers are sprung such that ends of the fingers are biased towards each other.
6. A planter in accordance with claim 5, wherein the fingers are curved.
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7. A planter in accordance with claim 6, wherein the plant extraction means comprises four fingers, arranged in two pairs.
8. A planter in accordance with any one of claims 5 to 7, wherein the plant extraction
30 means further comprises a spacer member, located between the fingers, and

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slidable in one direction to push the finger ends apart, and in the opposite direction to allow the ends to converge.

9. A planter in accordance with claim 8 wherein the spacer member is a block, the
5 fingers are arranged at sides of the block, and the block has a front edge, between the sides, which comprises a cut-out for engaging a stem of a plant.

10. A planter in accordance with claim 8 or claim 9 wherein the plant extraction
10 means is operable to slide the spacer member to the ends of the fingers to separate those ends, and is further operable to move the spacer member and fingers to a position relative to the locating means, such that in use the spacer member and fingers can be positioned adjacent to an upper surface of a root portion of a plant in a tray, and then to drive the fingers down past the sides of the spacer member, whereby the fingers can be inserted into a root portion of a plant and, at the same time, converge to
15 grip the root portion.

11. A planter in accordance with any one of claims 8 to 10, further comprising stop
means arranged to limit movement of the spacer member towards a located tray so as to prevent or limit compression of a root portion surface by the spacer member.
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12. A planter in accordance with any preceding claim, comprising a plurality of said
plant extraction means arranged in a row, whereby a row of plants can be pulled out of a located propagation tray simultaneously.

25 13. A planter in accordance with claim 12, wherein the plurality of plant extraction means are mounted on a gantry, the gantry being movable over a located tray.

14. A planter in accordance with claim 12 or claim 13, as dependent on claim 4,
comprising means for actuating the respective fingers of all plant extraction means to
30 converge substantially simultaneously.

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15. A planter in accordance with claim 14, wherein each plant extraction means comprises a respective spacer member slidable inside the respective fingers, the planter comprising means for sliding the spacer members simultaneously.

5 16. A planter in accordance with any one of claims 12 to 15, further comprising means for adjusting the separation of the plant extraction means in the row.

17. A planter in accordance with any preceding claim, wherein the delivery means comprises:

10 a delivery belt assembly arranged to convey an extracted plant from a first height to a second, lower height, the delivery belt assembly comprising two endless belts of resilient material, inclined and arranged adjacent one another so as to be able to grip the foliage part of an extracted plant between opposing surfaces of the belts; and
drive means arranged to drive the belts at the same speed and such that their
15 opposing surfaces move in the same direction.

18. A planter in accordance with claim 17, further comprising means for presenting extracted plants to the delivery belt assembly such that the foliage portions of the extracted plants are engagable by the endless belts.

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19. A planter in accordance with claim 17 or claim 18, wherein the delivery belt assembly is arranged to drop conveyed plants onto the ground.

20. A planter in accordance with claim 19, further comprising a colter the arranged
25 to cut a slot in the ground, the delivery belt assembly being arranged to drop plants, root portion first, into the slot.

21. A planter in accordance with claim 20, further comprising a pair of press wheel is arranged to close soil around dropped plants.

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22. A planter in accordance with any preceding claim, wherein the delivery means comprises:

a delivery assembly operable to receive an extracted plant and convey it from a first height the ground; and

5 plant transport means arranged to receive extracted plants from the plant extraction means and present them to the delivery assembly.

23. A planter in accordance with claim 22 wherein the plant transport means comprises a plurality of holding ports, each port being adapted to receive a root portion of
10 an extracted plant, and control means operable to hold the ports in a static state, whereby the ports can be loaded with extracted plants, and to move the ports to convey the received plans to the delivery assembly.

24. A planter in accordance with claim 23, comprising n plant extraction means,
15 where n is an integer, the plant transport means being adapted to provide n holding ports to receive n extracted plants substantially simultaneously.

25. A planter in accordance with claim 23 or claim 24 wherein the holding ports are provided by an endless belt structure.
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26. A planter in accordance with claim 25 wherein the endless belt structure comprises a plurality of fin pairings, wherein each fin pairing comes together to form a holding port.

25 27. A planter in accordance with claim 26, wherein at least one fin of each pair comprises a barb for retaining a received root portion in the holding port defined by the pair.

28. A planter in accordance with claim 26, wherein the barb is provided at a predetermined height from a base of the holding port, and the height of each fin from that
30 base is at least twice the height of the barb.

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29. A planter in accordance with any one of claims 23 to 28, further comprising an array of extraction fingers and means for driving the extraction fingers transversely into the holding ports, whereby the extraction fingers can penetrate the sides of the root portions of plants placed in the holding ports by the plant extraction means and hold the root portions as the plant extraction means is lifted away from the deposited plants.

30. A planter in accordance with any one of claims 23 to 29, further comprising a second plurality of holding ports, the control means being operable to hold one plurality of holding ports in a static state to enable the plant extraction means to deposit extracted plants in the static ports, and at the same time to move the other plurality of holding ports to convey previously deposited plants to the delivery assembly.

31. A planter in accordance with claim 30, wherein the second plurality of holding ports are provided by a second endless belt structure.

32. A planter in accordance with any one of claims 22 to 31, further comprising a sensor arranged to detect foliage of a plant being conveyed by the plant transport means, the sensor being arranged to provide a signal to a controller, the controller being further arranged to control drive means of the plant transport means, whereby if no foliage, or inadequately developed foliage, is detected the plant transport means can be controlled accordingly to ensure that adequately developed plants are presented to the delivery assembly at substantially regular intervals.

33. A planter assembly for planting plants extracted from propagation trays, the planter assembly comprising a delivery belt assembly arranged to convey an extracted plant from a first height to a second, lower height, the delivery belt assembly comprising two endless belts of resilient material, inclined and arranged adjacent one another so as to be able to grip the foliage part of an extracted plant between opposing surfaces of the belts; and

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drive means arranged to drive the belts at the same speed and such that their opposing surfaces move in the same direction.

34. A planter assembly in accordance with claim 33, further comprising means for
5 presenting extracted plants to the delivery belt assembly such that the foliage portions of the extracted plants are engagable by the endless belts.

35. A planter assembly in accordance with claim 33 or claim 34, further comprising
plant extraction means, arranged to extract a row of plants from a propagation tray
10 substantially simultaneously, and a plant conveyor, arranged to receive an extracted row of plants from the plant extraction means and to present the extracted plants sequentially to the delivery belt assembly.

36. A planter assembly in accordance with claim 35, comprising a second plant conveyor and conveyor control means adapted to hold one conveyor in a static state for
15 receiving extracted plants from the plant extraction means, and at the same time to move the other conveyor to convey previously received plants to the delivery belt assembly.

20 37. An automated planter comprising: plant extraction means adapted to remove a row of plants from a propagation tray; a delivery assembly arranged to receive extracted plants and deliver those extracted plants to the ground; first and second plant conveyors, each arranged to receive an extracted row of plants from the plant extraction means and to present the extracted plants sequentially to the delivery assembly;
25 and plant conveyor control means arranged to control the conveyors such that one is held in a static state to receive an extracted row of plants from plant extraction means while the other is driven to present a previously deposited row of plants to the delivery assembly.

30 38. A method of planting plants from a propagation tray, the method comprising steps of:

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inserting at least one insertion member into the root portion of a plant in the propagation tray, through the upper surface of the root portion, to grip the root portion;

pulling the plant out of the propagation tray;

5 presenting the extracted plant to delivery means; and

using the delivery means to convey the extracted plant to the ground.

39. A method in accordance with claim 38, and further comprising the step of pushing the foliage of the plant to one side before inserting the insertion member.

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40. A method in accordance with claim 38 or claim 39 wherein the step of inserting comprises driving at least two fingers into the root portion from the foliage side.

41. A method in accordance with any one of claims 38 to 40 further comprising the steps of pulling the plant out of the propagation tray such that the base of the root portion is separated from the top of the propagation tray by a distance of no more than the height of the root portion and then moving the extracted plant transversely to the upper surface of the propagation tray, whereby the plant can be separated from adjacent plants, with which its foliage may have been entangled, without pulling those adjacent plants out of the propagation tray.

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42. A method in accordance with any one of claims 38 to 41, comprising the step of pulling out a row of plants simultaneously from the propagation tray.

25 43. A method in accordance with claim 42, further comprising the step of approaching the row of plants from a direction transverse to the row and pushing the foliage of the row of plants to one side before inserting the insertion members.

44. The method in accordance with claim 42 or claim 43 further comprising the steps of holding the extracted row of plants in alignment and translating the line of plants in a direction perpendicular to that line; depositing the line of plants in a conveyor

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structure having a plurality of holding ports aligned with the line of plants; and operating the conveyor structure to move the deposited plants in line to present them in sequence to the delivery means.

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45. A method of planting plants from a propagation tray, the method being substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

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46. An automated planter or planter assembly substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.